EXECUTIVE SUMMARY

Background

The California-Nevada Super Speed Train Commission (CNNST) was formed in 1988 to promote the development of, and issue a franchise to build, a 269-mile super speed train system connecting Las Vegas with Anaheim and other points in Southern California. CNSST selected the superspeed Transrapid Maglev technology in 1991 as the ideal high-speed ground transportation system for this corridor. Since that time, different plans have been prepared to implement the project but one thing has become clear, namely, as with other high-speed ground transportation projects, that a franchisee could not finance such a project from operating revenues alone without substantial financial assistance from the public sector.

In 1998, as part of the Transportation Equity Act for the 21st Century, the federal Maglev Deployment Program was enacted in order to plan, build, and demonstrate a high-speed maglev system in an appropriate location somewhere in the United States. The program was run as a competition among State sponsors and their designated public agencies. The CNSST and its private sector partner, the American Magline Group (AMG), entered the competition with the "First Forty Miles" of its proposed system, the segment between Las Vegas' South Resort Corridor (SRC) and the town of Primm, on the California border, receiving federal matching funds to prepare a project description and plans for this segment. The Maglev Deployment Program envisioned a short segment such as this for the first demonstration because of the anticipated difficulty in raising the funds, both public and private, needed to build a longer intercity system.

CNSST prepared and submitted to DOT a Project Description report on the SRC-to-Primm segment in 2000. Even though the project was estimated to be by far the quickest, least expensive and the easiest to build among those in the competition, it was not among the two selected in January, 2001 by the U.S. Department of Transportation (DOT) for further study. Nevertheless, the U.S. Congress, perhaps mindful of these inherent advantages, appropriated additional funding in fiscal year (FY) 2002 for the project and is about to appropriate funding in FY 2003. The funding in FY 2002 was used to prepare plans for an extension of the first forty miles, from Primm to Barstow, and the funding in FY 2003 would be used to cover plans for the westernmost end of the overall corridor, the segment from Anaheim to Ontario on the California side.

This Report

The current report, known as the "Supplemental Project Description," presents projected physical infrastructure, ridership, costs, benefits and related information for the extended segment from SRC to Barstow via Primm, as shown in the map segment below.

Purpose and Significance of the Project

The main purpose of the overall Las Vegas-to-Anaheim project is to provide safe, rapid, reliable and environmentally benign transportation between the Las Vegas area and Southern California, two fast-growing and heavily populated regions of the U.S. The First Forty Miles would demonstrate the effectiveness of maglev technology to the millions of visitors to Las Vegas who come from all over the U.S. and the world. Once this is built, plus the Barstow extension, many of the additional benefits of the Las Vegas-to-Anaheim project could also be realized, because it would attract many of those whose trips originate in or are destined for points west of Barstow. Thus, building the extended project to Barstow represents an opportunity not only to demonstrate the maglev technology to a unique audience but also to improve travel, reduce intercity congestion, and accommodate significant travel growth in the 21st century with a truly high-speed intercity 154-mile magnetic levitation ground transportation system.

Physical Description

The technology chosen for the project is the Transrapid Maglev System, which has been under development in Germany for the last 30 years. The latest vehicle design, the TR-08, has been carrying paying passengers at speeds over 250 miles per hour daily at the full-scale, 19-mile test track in Emsland, Germany, since 1999.

The system is now being built for revenue operations in Shanghai, China between the Pudong International Airport and the city's financial center, a distance of 19 miles. The Shanghai project is expected to undergo service testing in 2003 and to carry revenue

passengers by 2004. The technology to be used in the Las Vegas-to-Barstow project is essentially the same as for Shanghai, except for potential innovations in the propulsion system to be designed by General Atomics, a member company of the AMG.

Transrapid received its certification of readiness for commercial application in Germany in 1991. Before it can be implemented in the U.S., the proposed application must be designed, described in great detail and then approved by the Federal Railroad Administration (FRA). The system is designed to attain its maximum cruising speed of 310 mph in both the short SRC-to-Primm section and the longer extension to Barstow. Other characteristics of the technology include: superior acceleration across the full speed range; the ability to climb 10% grades; and up to 12-degree banking on curves to maintain speed and comfort and minimize right-of-way acquisition.

The detailed route and options are not mapped in this report, but are treated in an earlier report on the Corridor Project. Because of the relatively flat and undeveloped terrain it is clear that there are few places along the SRC-to-Barstow project where the vehicles will need to slow down significantly. Only three stations are proposed: South Resort Corridor station, at the Las Vegas end at the intersection of Interstates 15 and 215; Primm, at Buffalo Bill's casino, a short distance from three hotels and an outlet mall; and Barstow, south of the city of Barstow, and also adjacent to I-15. From the South Resort Corridor station, the alignment runs along the east side of I-15, crossing over to the west side in the Mountain Pass area. It continues through gently sloping terrain, passing northwest of the small town of Baker. East of Baker, the alignment uses an existing power line route through the Soda Mountains and rejoins the I-15 alignment, leaving the right of way only in curved areas. The alignment proceeds along the south side of Barstow to the station next to I-15.

Hirschfeld Steel Corporation, another member of the AMG, has a guideway manufacturing plan that envisions a mass-production assembly line operation using advanced computer and robotics technology. Specialized plants would be built to fabricate the steel girders, and the same techniques would be usable by the American steel industry at a later date for other precision production jobs. Steel plate would be cut to size into segments, or components, of the girders and positioned for precision robotic welding. Component manufacturing would take place in a number of states in the East, South, and Midwest, while the final assembly would take place in the Southwest.

The SRC-to-Barstow route will have approximately 68 miles of single-track guideway and 86 miles of double-track guideway, allowing maglev trains to pass each other while maintaining 20-minute headways.

Service Characteristics

The trip times between stations are planned as follows:

South Resort Corridor to Primm:	11 minutes
Primm to Barstow:	32 minutes
South Resort Corridor to Barstow:	45 minutes

A possible future extension from SRC to downtown Las Vegas would add about nine minutes to these times. The planned service would operate at 20-minute headways from 6:00 a.m. to 1:00 a.m. along the entire route. Each trainset would be made up of two end sections and six middle sections, differing in passenger capacity. Initially, the trains serving SRC to Primm would be configured for "suburban" operations, with a capacity of 702 seated and 462 standing. With the later addition of service to Barstow, all trains would operate in through service, stopping in Primm, but in "intercity" configuration, including seating in 1st class and galley, for a total of 556 seated passengers and 175 possible standees.

Ridership and Revenues

Projected ridership between SRC and Primm, without the Barstow extension, would be drawn from four different market segments:

1. Las Vegas residents and visitors currently traveling to Primm for business or pleasure.
2. Primm visitors currently traveling to Las Vegas for business or pleasure.
3. Las Vegas residents commuting to Primm or the proposed Ivanpah Airport and Industrial Park.
4. Las Vegas visitors and residents riding the maglev to Primm instead of, or in addition to, trips to other points of interest in the Las Vegas area, as part of the many side trips or "tourist" trips made by the same population in the Las Vegas area.

Once the Barstow extension is built the project would draw additional riders from the following three California-based groups, who, if attracted to maglev, would travel through the Barstow station.

- Southern California residents and visitors traveling to Las Vegas by air.
- Southern California residents and visitors traveling to Las Vegas by auto.
- Southern California residents and visitors traveling to Las Vegas by charter bus.

In all cases, the method, or model, for estimating maglev ridership consisted of three sequential steps:

- first estimating the number of trips in each segment in the base year;
- projecting these numbers into future years using growth indices; and then
- using market research methods to estimate the percentage of trips in each segment that would be diverted or attracted to the new maglev service.

The market research involved a survey of 2,419 respondents in the Las Vegas area, including McCarran Airport, in which persons were asked which mode (including maglev) they would use for their trip under different conditions of trip time, frequency of service and fares.

Assuming fares for SRC to Primm at $6.00 for visitors and $4.00 to $5.00 for commuters, and fares from SRC to Barstow at $50, the following ridership (annual one way trips) is projected for year 2018.

First Forty Miles Market			
Visitors to Primm	28%		
Las Vegas Visitors from Primm	4%		
Primm & Ivanpah Employees			14%
Tourist Trip Diversion	54%		
	100%	13,964,000 trips	
Las Vegas to Barstow Market			
Auto Diversion	77%		

Charter Bus Diversion	6%	
Air Diversion	17%	
	100%	6,588,000 trips

The impact on projected ridership and revenue from using different fare assumptions was estimated using the ridership model. In particular, in the Las Vegas to Barstow market, ridership is projected to vary by about 1% for every dollar change from the base of $50. Also, reducing the headway to 15 minutes is estimated to result in an increase in Las Vegas to Barstow ridership of only 1%. This supports the operational decision to set the headway interval at 20 minutes, since the change to 15-minute headways would require a very large additional capital expense.

Using the ridership and fare levels, and allowing for ancillary revenues such as concession sales, total revenues were estimated as follows, in constant year 2000 dollars.

Year	**SRC – Primm ($000)**	**Barstow Extension ($000)**
2008/2012	77,694 [2008]	241,594 [2012]
2018		85,000
2028	86,928	346,312
2048	89,317	363,522

Thus, the extension to Barstow is projected to produce *three to four times as much revenue as the first forty miles*.

Benefits

The FRA report, "High Speed Ground Transportation for America," more commonly known as the "Commercial Feasibility Study (CFS)," identified a set of benefit categories that should be used in an economic analysis of high-speed ground transportation projects from a national viewpoint. These categories included (1) benefits to users of the high-speed system, (2) benefits to those who continue to use other transportation systems, such as through congestion relief due to shifting of traffic to the high-speed system, and (3) benefits to the public at large, such as pollution reduction.

The category typically of the greatest magnitude is (1), which can be divided into two components. The first is the total fares paid by the users, representing a partial measure of benefits received. The second component is the consumer surplus, which is additive to the total fares, and which represents the difference between what users pay and the higher values that some would be willing to pay for the service consumed. The latter component can be calculated using the ridership estimating model.

Of the second two categories of benefits, only reductions in delay to airline operators, air passengers and highway users, and reductions in accidents on I-15 are judged to be significant and quantifiable. In order to compare these benefit estimates with project costs, the projections of both benefits and costs are discounted to a base year using different discount rates, and summed. The results of such calculations are shown below for a 7% annual discount rate.

Benefit Category	**Discounted Value in 2008** (Millions of 2000 $)	**% of Total**

Revenues	4,522	31		
Consumer Surplus			4,855	
I-15 Fatalities				524
I-15 Delay	3,467	24		
Airline Delay	423	3		
Air Passenger Delay	773	5		
TOTAL	14,565	100		

In addition to the above benefits that are included in an economic assessment from a national viewpoint, there are other benefits which clearly would accrue to the local or regional economy, but which are largely offset by reductions in benefits accruing elsewhere. These economic development benefits from the SRC to Primm section alone are estimated as follows:

Initial benefits from construction:

- $1.3 billion in economic output
- $390 million in household income, and
- 7,400 new jobs (person-years of employment)

Continuing annual impacts from system operation:

- $80 million in economic output
- $28 million in household income, and
- 400 new jobs.

Given the larger magnitude of the expenditures for the Barstow extension, its construction is estimated to generate the following impacts:

- $5.1 billion in economic output
- $1.9 billion in household income, and
- 28,000 new jobs (person-years of employment)

As well as continuing annual impacts from system operation:

- $330 million in economic output
- $117 million in household income, and
- 1,700 new jobs.

Costs

The costs of the initial capital investments are estimated in three classes of elements, each of which requires a different estimating method. The "new technology" elements are those unique to the Transrapid system, and consequently are derived largely from Transrapid's experience. The "existing technology" elements are items presently used in other applications, such as transportation infrastructure construction, where standard engineering methods are used for estimation. The third class of elements are those requiring new fabrication or installation techniques, where the additional cost of the specialized fabrication facilities and equipment are taken into account. The estimated capital cost for the Las Vegas-to-Barstow segment expressed in 2000 dollars is $5.65 billion. When escalated to the midpoint of construction it is $7.03 billion. The cost

breakdown in millions of 2000 dollars is shown below. All elements include a 10% contingency except right-of-way, which has 20%, and engineering, etc., which has none.

Vehicles	435	7.7%
Propulsion System	823	14.6%
Energy Supply	258	4.5%
Operation and Communication Control	173	3.1%
Guideway Infrastructure	3189	56.4%
Stations	43	0.8%
Operations and Maintenance Facilities	67	1.2%
Right-of-way and Corridor	43	0.8%
Engineering/Management/Training	556	9.8%
TOTAL	5651	100%

Operating and maintenance costs are estimated in part using FRA's work breakdown structure and model from the CFS report, in part from Transrapid experience, and in part from additional research by Parsons Transportation Group using new data. These annual costs are shown below in millions of year 2000 dollars for the year 2018.

Maintenance of Way			16.7
Maintenance of Equipment	72.1	39.0%	
Transportation	59.9	32.4%	
Passenger Traffic & Services	13.6	7.4%	
General and Administrative	22.5	12.2%	
TOTAL	184.7	100%	

A final category of costs is continuing investments, that is, capital expenses that are expected to be required at certain points in later years. No major infrastructure or vehicle expansion or replacement is envisioned during the life of the facility, and therefore these costs, primarily for an 8-year vehicle overhaul program beginning in 2028, amount to only about an added 3% of operating and maintenance costs on a present value basis.

Economic Analysis and "Partnership Potential"

The term "partnership potential" has two meanings in this report. The first refers to the existence of or the prospect for the existence of a public/private partnership that is ready, willing, and able to finance, construct, operate, and maintain the project. The second refers to a finding that must be made for the project to be eligible for Federal assistance under the Maglev Deployment Program, namely that total benefits exceed total costs and that total revenues exceed operating and maintenance costs plus continuing investment costs, a condition which is considered a minimum prerequisite for such a partnership.

The partnership already exists. On the public side, it consists of the sponsoring agency, the California-Nevada Super Speed Train Commission, and the Nevada Department of Transportation. On the private side, it consists of the team committed to design, build, operate, and maintain (DBOM) the project: American Magline Group (AMG), Transrapid International USA (TRI-USA), and Salomon Smith Barney. The American Magline Group is a joint venture between General Atomics, Parsons Transportation Group, Hirschfeld Steel, and M. Neil Cummings & Associates, APLC. Recently the Southern

California Association of Governments and the California-Nevada Super Speed Train Commission formed the Western States Maglev Alliance to advocate the "First Forty Miles" in Nevada as the first U.S. project to receive federal construction funds under the Maglev Deployment Program.

The partnership has obtained resolutions of support from all the cities in California and Nevada along the I-15 route alignment. These resolutions express the intentions of the city councils to work with the partnership to acquire the necessary land. AMG and TRI-USA entered into an agreement in 1999 giving the project access to the Transrapid technology and the parties are working together on the design and "Americanization" of the system. Plans for the first forty miles call for over 70% of the project's capital cost to consist of labor and materials from U.S. suppliers.

When total benefits for the Las Vegas to Barstow project, expressed in 2000 dollars, are discounted to year 2008 at 7% annual discount rate, the result is $14.56 billion. This compares to a total discounted cost of $7.71 billion, resulting in a benefit/cost ratio of 1.9, and more than fulfilling the first requirement of the CFS partnership potential finding. Also, discounting total revenues to 2008 results in a sum of $4.52 billion, well in excess of the $2.15 billion in operating and maintenance and continuing investment costs, thereby fulfilling the second CFS requirement.

Project Schedule

The implementation plan for the SRC to Barstow project calls for design of the Barstow extension to occur during the construction of the SRC to Primm segment, and for construction of the extension to begin during the final testing and commissioning of the first segment. The first step will be to begin the Environmental Impact Statement for the combined project in October 2002, aiming for a formal Record of Decision by September 1, 2004. Construction would then begin immediately on the first segment, with anticipated completion in mid-2007 and revenue service by January, 2008. Meanwhile, engineering of the much longer Barstow extension would have begun in early 2005 with completion and start of construction two years later. Revenue service on the extension is anticipated to begin in April, 2012.

The two-year schedule for the environmental work is predicated on no significant public opposition to the project and no significant impacts on cultural or biological resources being found. These assumptions are made in light of extensive outreach and environmental analysis already completed in an earlier phase.

Financial Plan

Since the construction and financing of the first forty miles precedes, and is independent of, the Barstow extension, the financing of the Las Vegas to Barstow project must be considered as two separate—but related—undertakings. For each of the segments, Salomon Smith Barney (SSB) has prepared a plan that relies in part on three tiers of non-recourse tax-exempt bond financing, with senior, junior, and subordinate liens, respectively. Each of these tiers has its own assumed interest rate (6.5%, 7%, and 8%, respectively) and therefore different coverage ratios. The amounts of these bonds and other sources of funding are shown below under two basic assumptions: (1) that the bonds would be secured by net project revenues (i.e. gross revenues would be used first to pay for operating and maintenance costs), and (2) that excess revenues from the first segment would not be used to offset costs of the Barstow extension.

Primm Segment

Funding Source	Amount ($ in millions)
Senior Lien Tax-Exempt Bonds	$396
Junior Lien Tax-Exempt Bonds	191
Subordinate Lien, Tax-Exempt Bonds	87
Construction Fund Earnings	43
Other	950
Total [1]	$1,667

Barstow Segment

Funding Source	Amount ($ in millions)
Senior Lien Tax-Exempt Bonds	$2,482
Junior Lien Tax-Exempt Bonds	991
Subordinate Lien, Tax-Exempt Bonds	481
Construction Fund Earnings	932
Other	2,147
Total [1]	$7,033

The "other" funding represents a variety of possible sources that do not depend on project revenues. For example, the $950 million shown with the Primm segment represents the potential Federal grant currently authorized under the Maglev Deployment Program. Other potential funding sources in this category include Federal grants such as the Congestion Mitigation and Air Quality Improvement Program, the Surface Transportation Program, and the Transportation and Community and System Preservation Pilot Program; state and local grants; parking fees, and various types of tax assessments.

SSB also presented alternative assumptions that would serve to reduce the amount of "other" financing needed. For example, by using excess revenues from the first segment to offset costs for the Barstow extension and by requiring the system operator to absorb any operating and maintenance cost overruns, the amount of other financing for the Barstow extension could be cut substantially.

Conclusion

This report shows that the SRC to Barstow project can be built in two distinct stages.

The "First Forty Miles," from SRC to Primm, would demonstrate to the American public and foreign visitors—a total of about 13 million riders per year—the capabilities of maglev technology, and would cost significantly less than other demonstration projects under consideration by DOT.

The project extension to Barstow would represent a 154-mile intercity application of this high-speed ground transportation technology. Its realization is feasible through an existing public/private partnership with extensive community support and deserves serious consideration as a high-priority project.